View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Elsevier - Publisher Connector

# HISTORICAL VIGNETTES IN VASCULAR SURGERY

**Norman M. Rich, MD, Section Editor**

# On the 60th anniversary of carotid surgery for the prevention of stroke

**James O. Menzoian, MD,** *Farmington, Conn*

On May 19, 1954, at St. Mary's Hospital, London, a 66-year-old woman underwent a resection of the left internal carotid artery (ICA), and cerebral revascularization was accomplished by an anastomosis between the common carotid artery (CCA) and ICA to re-establish flow into the left ICA. The surgery was performed because the patient was having numerous neurological events including intermittent left-eye blindness and weakness of her right arm and leg. In addition, the patient reported that during one of these attacks, she tried to call her son but found that she could not speak. Her son gave her a glass of water, which she could not swallow. When the patient covered her right eye with her left hand, she found that she was blind. About a half hour later, the symptoms disappeared. Pertinent findings on physical examination revealed good-quality common carotid pulses bilaterally but a diminished left ICA pulse and absent left facial and temporal artery pulses. The patient had 33 similar events from December 1953 to the time of surgery. Her physicians were concerned that if the left ICA stenosis that was demonstrated by a direct puncture carotid angiogram was left untreated, the patient could have permanent neurologic injury.

The details of the surgery include lowering the patient's body temperature to 28°C (82.4°F) by lowering her into an ice bath. The CCA, the ICA, and the external carotid artery (ECA) were exposed. These vessels were adherent in the region of the carotid bifurcation. The carotid bifurcation was resected for a distance of 3 cm, dividing the ECA distally and anastomosing the proximal ECA to the distal end of the divided ICA (Fig 1). The surgeons had originally planned to insert a blood vessel graft but found this not to be necessary. The carotid artery was clamped for a total of 28 minutes. No anticoagulation was used, and the patient was gradually rewarmed. After surgery, she had no abnormal neurological findings. The patient was up and walking 48 hours later and was discharged home on June 2, 1954. When seen in follow-up on October 20, 1954, she had no neurologic events and was able to maintain her normal daily activities. In their report published in the November 1954 issue of *The Lancet*,[1] Eastcott, Pickering, and Rob state, "we present this case therefore not as proof as to how these attacks of hemiplegia and blindness were produced, but as evidence

**Fig 1.** Resected carotid artery bifurcation.

From the University of Connecticut Health Center and the University of Connecticut School of Medicine, Department of Surgery, Section of Vascular Surgery.

Author conflict of interest: none.

Reprint requests: James O. Menzoian, MD, University of Connecticut Health Center and the University of Connecticut School of Medicine, Department of Surgery, Section of Vascular Surgery, 263 Farmington Ave, Farmington CT 06030 (e-mail: jmenzoian@uchc.edu).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

J Vasc Surg 2014;59:1465-8
0741-5214/$36.00

Copyright © 2014 by the Society for Vascular Surgery.

http://dx.doi.org/10.1016/j.jvs.2013.12.035

that when such attacks are associated with internal carotid obstruction it is possible that they may be abolished by removing the obstruction to the internal carotid artery." Thus, the era of modern carotid surgery was born.

As with so many other unique contributions, this landmark operation did not occur in a vacuum. Many other significant events had to occur to enable these surgeons to present to the world this clear proof that disease in the carotid artery was contributing to major neurologic symptoms and that correction of the carotid artery pathology could improve the clinical picture. In 1905, Chiari[2] reported postmortem findings of plaques at the carotid bifurcation in patients with neurologic symptoms and suggested that extracranial carotid occlusive disease could be responsible for these symptoms. This was further reinforced by Ramsey Hunt[3] in 1914, who suggested that diminished cerebral flow from obstructive lesions of the carotid artery could lead to "cerebral intermittent claudication." He presented a number of cases of carotid artery injury resulting in neurologic symptoms. Changes in the brain consistent with cerebral destruction were found in patients who died as a result of these injuries. He also described a series of patients with hemiplegia and reduced carotid pulsations in the neck that suggested obstructive lesions in the carotid artery as possible sources of the hemiplegia. He writes "I would urge that all cases presenting cerebral symptoms of vascular origin, that the main arteries of the neck be carefully examined for a possible diminution or absence of pulsation." Similarly Miller Fisher,[4] in 1951, described eight patients with carotid occlusion demonstrated by clinical examination, arteriography, or postmortem examination. These cases again support a correlation between occlusive disease of the carotid artery and clinical and pathological changes in the brain. Dr Fisher comments, "It is even conceivable that someday vascular surgery will find a way to by-pass the occluded portion of the artery during the period of ominous fleeting symptoms."

Visualization of the carotid lesion was essential because other than physical examination, which may have noted a diminished carotid pulse, the only other available method of evaluating any possible carotid pathology was by use of carotid angiography. This was first demonstrated by Moniz[5] in 1927, who reported a large number of carotid angiograms that were accomplished by means of surgical exposure of the carotid artery. Subsequent to this, Loman and Myerson[6] reported in 1936 a technique of direct carotid puncture that was the technique used at St. Mary's Hospital in 1954.

For patients presenting with neurological symptoms, in this time period there were three surgical options. Arterectomy, which involves the removal of the diseased segment of artery, was thought to alleviate vasospasm. The thinking at the time was that arterial thrombosis induced a reflexive vasospasm of the blood vessel beyond the occlusion and that alleviation of this spasm would increase cerebral blood flow. Leriche,[7] who was one of the early proponents of this concept and technique, stated that "an obliterated artery ceases to be an artery and becomes a diseased sympathetic nerve." He suggested removal of the entire occluded artery if possible. Chao[8] in 1938 reported two cases of carotid resection in patients with occluded carotid arteries and neurologic symptoms. He agreed with the principle espoused by Leriche that resection of the occluded carotid artery would interrupt the continuity of the sympathetic impulse in the wall of the carotid artery and thus enhance cerebral blood flow. One patient who had symptoms of transient ischemic attack improved after the surgery, but the second patient, who had a complete stroke with hemiparesis, showed minimal improvement in mentation and movement on the affected side.

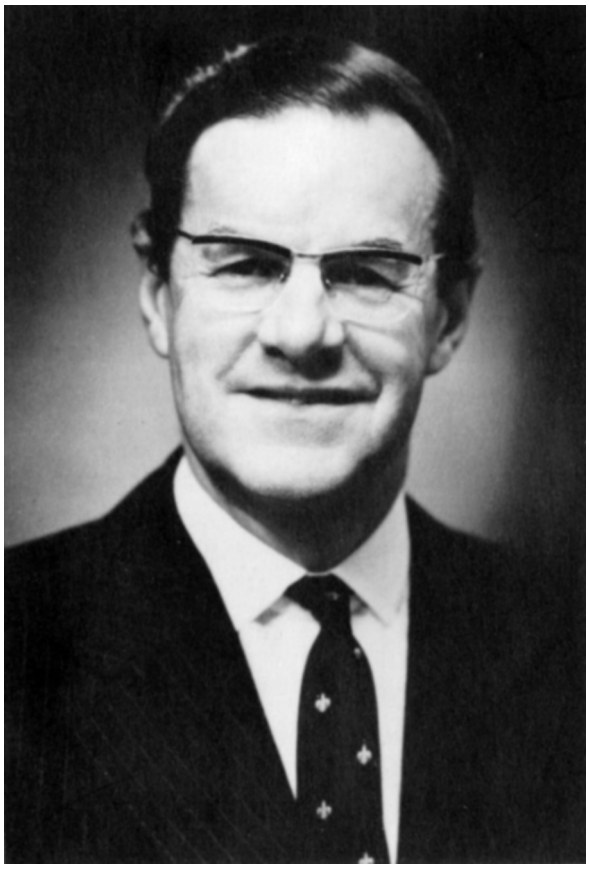

**Fig 2.** H.H.G. Eastcott.

Cervical sympathectomy was also performed for the same reason to reduce vasospasm and thus enhance cerebral blood flow. Sympathectomy was accomplished either by cervical ganglionectomy or periarterial stripping.

In a review of 101 cases from the literature that used arterectomy, ganglionectomy, and sympathectomy and a presentation of six new cases, Johnson and Walker,[9] in 1951, reported that in some cases the patients improved after these procedures.

Thromboendarterectomy was also performed in many patients with total carotid occlusion. This involved removal of thrombus, and, if there was no back-bleeding, the vessel

**Fig 3.** Carotid artery reconstruction operation at St. Mary's Hospital, London, May 19, 1954; H.H.G. Eastcott (*back to the camera*) and Charles Rob (*far left* of the photograph).

was ligated. The first reported case of thromboendarterectomy of the carotid artery was by Strully,[10] but it was not the type of endarterectomy that we currently perform. In a patient with a stroke and an angiogram demonstrating an occluded ICA, the surgery was performed to remove the obstructing lesion. However, once the clot was removed, there was no back-bleeding and therefore the authors resected a portion of the carotid artery and then ligated the artery to prevent any distal embolization of retained material. In 1975, Debakey[11] published a 19-year follow-up of what he believed was the first successful carotid endarterectomy in a patient with multiple transient ischemic attacks. On August 7, 1953, he performed the traditional carotid endarterectomy that is done today by removing the atheromatous plaque with attached fresh clot, with primary closure of the carotid artery.

It should be noted that on October 20, 1951, in Buenos Aires, Carrea, Molins, and Murphy[12] performed a similar carotid resection and ECA-to-ICA anastomosis in a patient with recurring neurologic symptoms, with an excellent result. This case was reported in 1955,[12] well after the report from St. Mary's Hospital.

The surgeons at St. Mary's Hospital continued to perform carotid interventions for patients with neurologic symptoms. Edwards and Rob[13] reported a case of carotid revascularization by carotid resection followed by direct end-to-end anastomosis of the ICA and the CCA in a patient with persistent difficulty in speaking, weakness in his right hand, and poor control of his right leg. On the first postoperative day, the patient had a normal neurological examination. This is the first reported case of complete neurologic recovery after removal of a nearly occluding ICA plaque. In 1957, Rob and Wheeler[14] reported the institutional experience at St. Mary's Hospital with 27 cases of direct arterial surgery. In 11 patients with partial occlusion of the ICA, eight underwent thromboendarterectomy and three had resection and end-to-end anastomosis. In this partial occlusion group, all patients had restoration of flow. Of the 16 patients with total occlusion, four underwent thromboendarterectomy and 12 had arterectomy. In this group, only four patients had restoration of flow. The authors report that "the patients most likely to benefit from surgery are those with incomplete occlusions who first come to a doctor because of symptoms of cerebrovascular insufficiency."

In August of 1987, Mr Eastcott (Fig 2) sent a letter to Drs William S. Fields and Noreen A. Lemak.[15]

"The operation of May 19, 1954, was photographed by a visiting surgeon (Fig 3), a member of a distinguished traveling club from the states that included Drs DeBakey and Wylie, to whom Charles Rob showed the patient on their ward visit the previous day. He remembered that Jack Wylie suggested that an endarterectomy should be considered. During the event, I was given the freedom to make my own operative decision, in the generous and wise way that Charles has with his juniors, and I elected to excise the bifurcation and anastomose the CCA and ICA, just as I had done in my Harvard Medical School days, and in an old man with malignant lymph nodes involving the CCA, about a year before the present case. It took 28 minutes of clamp time, the cerebral protection being provided by induced hypothermia at 28°C. The photographer that day was none other than Dr George Dunlop, who many years later in 1977, as President of the American College of Surgeons, invested me as Honorary Fellow. He lent the slide to Dr Jesse Thompson for his lecture to the Society of Vascular Surgeons/International Cardiovascular Society at Albuquerque in 1976 (I believe it was), at which time Jesse made a most glowing reference to our influence in setting

this whole surgical activity in motion. It came as a total surprise to me at the time, for I never knew that any photograph had been taken."

Sixty years ago, surgeons recognized the fact that extracranial carotid artery pathology could cause neurologic symptoms, that visualization of the obstructing lesion by carotid angiography was possible, and that it was possible to reestablish carotid artery flow through a flow-limiting diseased area. These represent major contributions to the care of patients with carotid artery disease. It is estimated that there are now approximately 100,000 carotid artery interventions annually. We owe thanks to many individuals for their contributions to our knowledge so that we can care for patients with carotid artery disease. On this 60th anniversary of that sentinel event that took place at St. Mary's Hospital in 1954, we are especially indebted to H.H.G. Eastcott, G.W. Pickering, and C.G. Rob.

## REFERENCES

1. Eastcott HHG, Pickering GW, Rob CG. Reconstruction of internal carotid artery. Lancet 1954;2:994-6.
2. Chiari H. Uber des verhalten des teilungswinkels der carotis communis bei der endarteritis chronica deformans. Verh Dtsch Ges Pathol 1905;9:326-30.
3. Hunt JR. The role of the carotid artery in the causation of vascular lesions of the brain, with remarks on certain special features of the symptomatology. Am J Med Sci 1914;147:704-13.
4. Fisher M. Occlusion of the internal carotid artery. Arch Neurol Psych 1951;65:346-77.
5. Moniz E, Lima A, de Lacerda R. Hemiplegies par thrombose de la carotid interne. Presse Med 1937;45:977-80.
6. Loman JM, Meyerson A. Visualization of the cerebral vessels by direct injection of thorium dioxide (Thorotrast). AJR 1936;35:188-93.
7. Leriche R. Arterectomy in the treatment of localized arterial obliterations. Am J Surg 1931;14:55-9.
8. Chao WH, Kwan ST, Lyman RS, Loucks HH. Thrombosis of the left internal carotid artery. Arch Surg 1938:100-11.
9. Johnson HC, Walker AE. The angiographic diagnosis of spontaneous thrombosis of the internal and common carotid arteries. J Neurosurg 1951;8:631-59.
10. Strully KJ, Hurwitt ES, Blankenberg HW. Thrombo-endarterectomy for thrombosis of the internal carotid artery in the neck. J Neurosurg 1953;10:474-82.
11. DeBakey ME. Successful carotid endarterectomy for cerebrovascular insufficiency. JAMA 1975;233:1083-5.
12. Carrea R, Molins M, Murphy G. Surgical treatment of spontaneous thrombosis of the internal carotid artery in the neck: carotid-carotideal anastomosis: report of a case. Acta Neurol Latin Am 1955;1:71-8.
13. Edwards C, Rob C. Relief of neurological symptoms and signs by reconstruction of a stenosed internal carotid artery. BMJ 1956;2:1265-7.
14. Rob C, Wheeler HB. Thrombosis of internal carotid artery treated by arterial surgery. BMJ 1957;2:264-6.
15. Fields WS, Lemak NA. Cerebrovascular Surgery in a History of Stroke: Its Recognition and Treatment. New York: Oxford University Press; 1989.

Submitted Nov 26, 2013; accepted Dec 19, 2013.